DOCUMENT RESUME

ED 455 748

HE 034 222

AUTHOR	Mulvey, Patrick J.; Nicholson, Starr
TITLE	Enrollments and Degrees Report. AIP Report.
INSTITUTION	American Inst. of Physics, College Park, MD. Statistical Research Center.
REPORT NO	AIP-R-151.37
PUB DATE	2001-08-00
NOTE	14p.; For the previous "Enrollments and Degrees Report," see ED 446 623.
PUB TYPE	Numerical/Quantitative Data (110) -- Reports - Research (143)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	*College Graduates; *Degrees (Academic); Educational Trends; *Higher Education; *Physics; Sex Differences; Tables (Data); Trend Analysis; Undergraduate Students

ABSTRACT

In fall 1999, the 762 degree-granting physics departments in the United States were asked to provide information on their current enrollments and recent degrees, and data were received from 93% of the departments. The number of individuals receiving physics bachelor's degrees was at a 40-year low, with 3,646 degrees conferred in the class of 1999. The representation of women among degree recipients, however, reached a new high, with women earning 21% of the physics bachelor's degrees. Graduate student enrollments in physics increased in 1999 for the first time in almost a decade. The class of 1999, however, marked the fifth consecutive year that physics Ph.D. production fell. There were 1,262 degrees conferred, a decline of 5% from the previous year and a 15% decline since a recent high in 1994. An appendix contains tables describing recent trends in physics enrollments and degrees conferred. (SLD)

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AIP REPORT

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AIP Pub. Number R-151.37

August 2001

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ENROLLMENTS AND DEGREES REPORT

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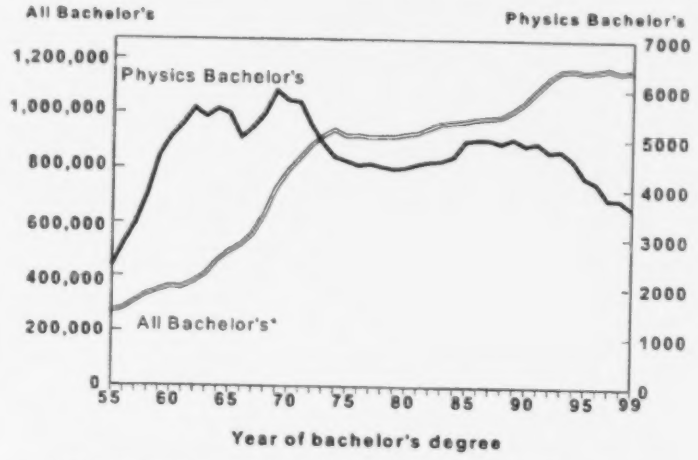
ENROLLMENTS AND DEGREES REPORT

Figure 1. Physics bachelor's and total bachelor's produced in the US, 1955 to 1999.



AIP Statistical Research Center, Enrollments and Degrees Report, and
* NCES Digest of Education Statistics

Highlights

▹The number of individuals receiving physics bachelor's degrees is at a 40 year low. There were 3646 degrees conferred in the class of 1999. **(Figures 1 & 2)**

▹The representation of women among physics bachelor's reaches a new high. Women earned 21% of the physics bachelor's in the class of 1999, an increase of 2% from the previous year. **(Figure 7)**

▹For the first time in almost a decade, first-year graduate student enrollments have shown a significant increase, rising 4% from the size of the previous year's incoming class (see **Figure 4**).

▹The class of 1999 makes the fifth consecutive year that physics PhD production has fallen. There were 1,262 degrees conferred, a decline of 5% from the previous year and a 15% decline since a recent high in 1994. Such declines are expected to continue for at least a couple years more. **(Figure 6)**

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Recent years have seen some dramatic changes in enrollment and degree patterns among US physics departments. In 1999 there were 3,646 physics bachelor's conferred, 26% fewer than there were just eight years earlier. The number of students emerging with physics masters degrees from masters-granting departments is about half of what it was in the early 1990's, and PhD production has fallen 15% during the last five years. However, while degree production is down for all levels and declines will continue for a number of years at the doctorate level, the enrollment totals for first-year graduate students and junior-level physics majors are now showing modest increases.

Table 1. Departments by highest physics degree offered, 1998-99.

	Number of Depts.	Percent of Depts.
PhD-granting	184	24
Master's-granting	70	9
Bachelor's-granting	508	67
Total	762	100%

AIP Statistical Research Center, Enrollments and Degrees Report.

In the fall of 1999 we asked the 762 degree granting physics departments in the US and Puerto Rico to provide information on their current enrollments and recent degrees (**see Table 1**). We received data from 93% of the departments. Since these data are so heavily relied upon by the physics community and crucial for our subsequent student surveys, a great deal of effort was spent obtaining as many responses as possible. Data for the non-responding departments were estimated from previous survey responses and are included in the totals presented in this report.

Introductory course enrollments at physics departments remain strong. **Table 2** shows the distribution of students by highest degree offered at the department and the type of course in which the students were enrolled. These enrollment figures are meant to reflect only the enrollments in the first term of an introductory level class. The continuing demand for introductory physics and science instruction illustrates the important role physics departments play in providing service courses to a wide range of majors in other fields.

Table 2. Introductory course enrollments by type of department, academic year 1998-99.

Department Type	Calculus Based	Algebra Based	Conceptual	Astronomy	Physical Science
PhD-granting	94,000	61,000	21,000	41,000	12,000
Master's-granting	13,000	15,000	14,000	19,000	5,000
Bachelor's-granting	39,000	38,000	24,000	45,000	24,000
Total	146,000	114,000	59,000	105,000	41,000

Note: The astronomy course enrollments do not include students at astronomy degree-granting departments, which account for another 51,900 introductory astronomy students.

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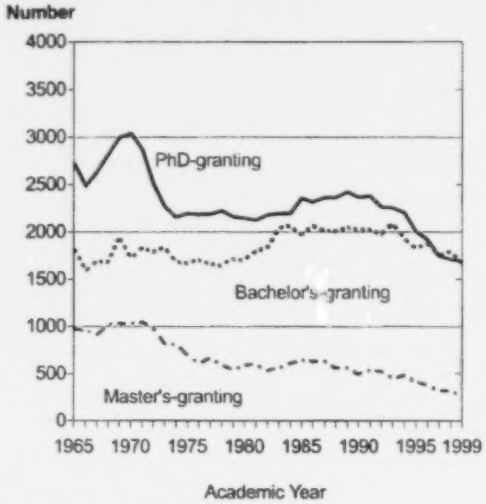
Figure 2. Physics bachelor's degrees awarded by department type, 1965-1999.



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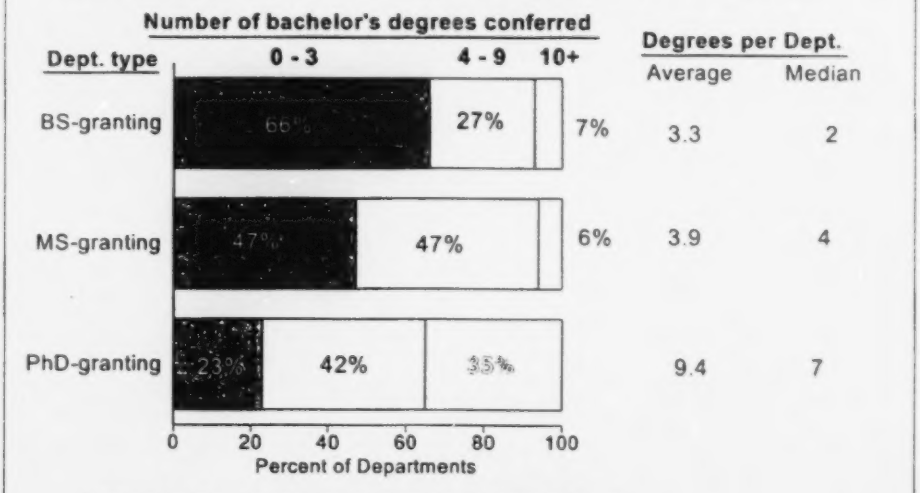
Even though they have recently experienced the greatest declines in bachelor's degree production, departments with physics graduate programs are still home to the largest undergraduate programs in the country (see **Figure 3**). For the class of 1999, these larger research-orientated departments averaged about nine physics bachelor's. In contrast, departments offering the bachelor's as its highest degree averaged only about three degrees.

As illustrated in **Figure 2**, the decline in bachelor's degree production during the last decade, like the decline experienced in the early 1970's, was not uniform across department type. Departments that also had a graduate program, especially a PhD program, were responsible for the bulk of the declines during both periods. Both downturns in production happened during poor economic times when PhD scientists were experiencing extremely difficult employment prospects. The disproportionate decline may, in part, stem from the fact that a larger fraction of physics bachelor's who attend universities with a graduate physics program had the intention to continue on with graduate study in physics before enrolling as an undergraduate. (AIP: 1999 Initial Employment Report: Follow-up of 1998 Physics and Astronomy Degree Recipients).

Figure 3. Distribution of physics departments by size of physics bachelor's class and type of department, class of 1999.



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Overall, 1999-2000 junior-level physics enrollments rose 4% from the previous year. PhD departments, which had experienced the greatest declines in bachelor's degree production, are now experiencing the greatest gains in junior-level enrollments. We anticipate an increase in the number of students receiving physics bachelor's degrees in coming years.

Table 3. PhD-granting departments averaging 20 or more physics bachelor's degrees per year, 1997-1999

	3-Year Average of Bachelor's Degrees Granted
Harvard U (MA)	52
Mass Inst of Tech	47
U of CA-Berkeley	44
Brigham Young U (UT)	41
U of Washington	39
U of Virginia	33
U of CA-Los Angeles	30
Rutgers U-Busch (NJ)	29
Portland St U (OR)	26
Cal Inst of Tech	25
U of IL-Urbana/Champaign	25
U of Texas-Austin	24
U of CA-San Diego	24
U of Utah	24
U of Colorado-Boulder	22
Georgia Inst of Tech	22
U of CA-Irvine	22
Ohio St U	20

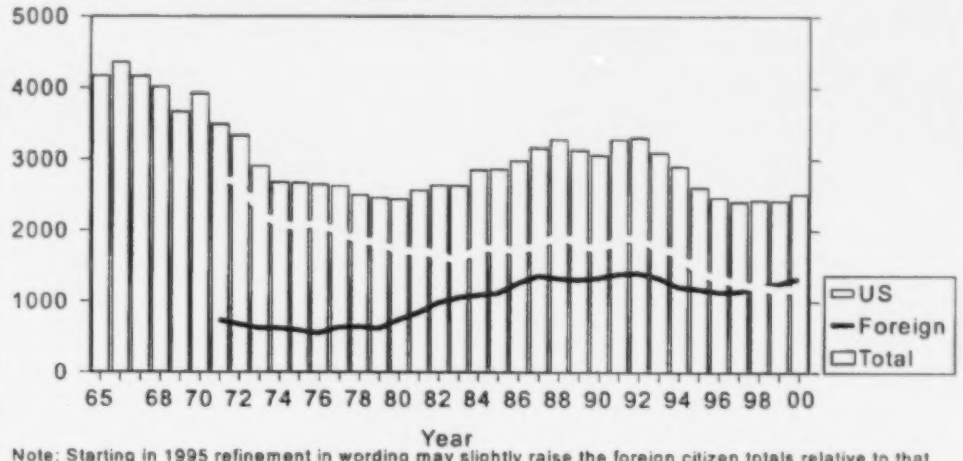
AIP Statistical Research Center, Enrollments and Degrees Report.

Table 4. Bachelor's-granting departments averaging 10 or more physics bachelor's degrees per year, 1997-1999

	3-Year Average of Bachelor's Degrees Granted
US Air Force Academy (CO)	22
US Naval Academy (MD)	21
Reed College (OR)	18
SUNY Geneseo Coll (NY)	17
Harvey Mudd Coll (CA)	16
Xavier U (LA)	15
Longwood College (VA)	15
Bates College (ME)	13
St. Olaf College (MN)	13
US Military Academy (NY)	13
Illinois St U	13
Whitman College (WA)	13
U of Puget Sound (WA)	12
Carleton College (MN)	11
Lawrence U (WI)	11
Middlebury College (VT)	11
Western Washington U (WA)	11
Pomona Coll (CA)	10
Winona St U (MN)	10
Swarthmore College (PA)	10
Wartburg College (IA)	10
Kalamazoo College (MI)	10
Colgate U (NY)	10
College of Charleston (SC)	10
Santa Clara U (CA)	10
Bethel College (MN)	10

AIP Statistical Research Center, Enrollments and Degrees Report.

Figure 4. First-year US and foreign graduate physics students, 1965 to 2000.



Note: Starting in 1995 refinement in wording may slightly raise the foreign citizen totals relative to that reported in earlier years. A citizenship breakdown of first-year student enrollments is not available prior to the academic year 1970-71.

Source: AIP Statistical Research Center, Enrollments and Degrees Report

For the first time in almost a decade, first-year graduate student enrollments have shown a significant increase, rising 4% from the size of the previous year's incoming class (see **Figure 4**). Although enrollments are increasing, they are almost entirely attributable to a growing number of foreign students. The incoming class of foreign students in 1999-2000 was up 6% from the previous year, while the US students only experienced a 1% increase. Foreign citizens represented 53% of the incoming students and now make up 49% of the graduate students' studying at US physics departments.

The number of students exiting their department with a master's degree at both doctoral-granting and masters-granting departments fell significantly from the previous year's totals, dropping 6% and 31% respectively (see **Figure 5**). Furthermore, the number of students now receiving master's degrees from master's institutions is less than half of what was being produced in 1992. On the other hand, the number of students receiving a master's enroute at a doctoral-granting institution rose almost 8% from the previous year, indicating that the end to the sharp decline in PhD production may now be in sight.

Figure 5. Master's degrees conferred by type of degree and department, 1983-1999.

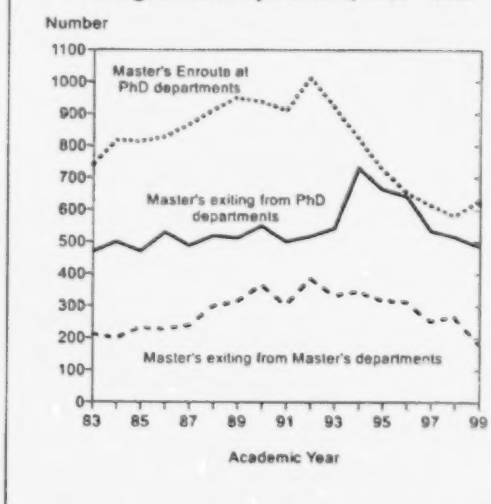


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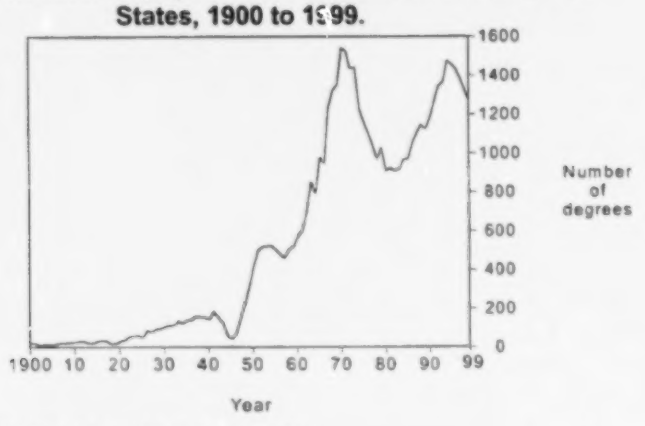
Figure 6. Number of physics PhDs conferred in the United States, 1900 to 1999.



Sources: ACE (1900-19), NAS (1920-61), AIP (1962-99)
AIP Statistical Research Center, Enrollments and Degrees Report

Figure 6 displays a century's worth of PhD production in the US. The number of PhDs conferred to the class of 1999 was 1,262, a decline of almost 5% from the previous year. This represents the fifth consecutive year that PhD production has fallen. Although the data on incoming graduate students and enroute master's degrees suggests a change in this trend, annual declines of this magnitude are expected to continue through 2002 or 2003.

Table 5. Departments averaging 20 or more physics doctorates per year, 1997-1999

	3-Year Average of PhDs Granted
Mass Inst of Tech	43
U of Texas-Austin	34
U of IL-Urbana/Champaign	33
U of CA-Berkeley	32
Cornell U (NY)	27
U of Maryland-College Park	27
Cal Inst of Tech	23
U of Chicago (IL)	23
SUNY-Stony Brook (NY)	22
U of Colorado-Boulder	21
U of WI-Madison	21
Princeton U (NJ)	21
U of CA-Los Angeles	20
U of CA-San Diego	20

AIP Statistical Research Center, Enrollments and Degrees Report.

Table 6. Percent of women and foreign citizens among recent physics degree recipients, Class of 1999.

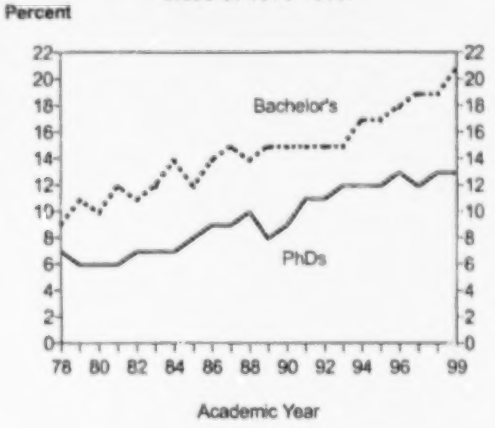
Degree	Women %	Foreign* %
Bachelor's	21	7
Exiting Master's	18	42
PhDs	13	47

* Foreign citizens include individuals with permanent resident status and temporary visas.

AIP Statistical Research Center, Enrollments and Degrees Report.

The proportion of women receiving physics bachelor's degrees increased 2% from the previous year. Women represented 21% of the class of 1999 physics bachelor's, the highest percentage achieved since we started collecting such data. The representation of women among the PhD recipients has remained fairly stable in recent years at around 13% (see **Figure 7**).

Figure 7. Percent of bachelor's degrees and doctorates in physics earned by women, class of 1978-1999.



Note: A from change occured in 1994 resulting in a more accurate representation of women among physics bachelors. Some of the increase in 1994 may be a result of that change.

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Table 8. Institutions consistently reporting race and averaging 4 or more African-American physics bachelor's per year, 1996-98.

	3-Year Average
Xavier U (LA)	15
Southern U & A&M Coll (LA)	10
Lincoln U (PA)	9
Alabama A&M U (AL)	5
Benedict Coll (SC)	4
Chicago St. (IL)	4
Howard U (DC)	4
Jackson St U (MS)	4
Norfolk St U (VA)	4
Tennessee St (TN)	4

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Hispanic-Americans and African-Americans continue to be greatly under-represented among physics degree recipients (see **Table 7**). The 35 historically black colleges and universities (HBCU) with physics degree programs were responsible for producing two-thirds of the African-American bachelor's receiving physics degrees in the class of 1999. Only 52 African-Americans earned their physics bachelor's from the 728 majority institutions.

Despite its diversity in terms of background, the Hispanic population in this country tends to be concentrated in a few states. Not surprisingly, the proportion of physics bachelor's who are Hispanic is far higher in some of these states. The states or territories with over 4% of their physics undergraduate degrees being awarded to Hispanics (more than twice the national rate) are: Arizona, California, Florida, New Mexico, Texas and Puerto Rico.

Table 7. Number and percent of physics degrees granted to US citizens by minority / ethnic group status, Class of 1999.

	Bachelor's		Exiting Master's		PhD's	
	Number	Percent	Number	Percent	Number	Percent
African-American	160	5	24	6	10	1
Hispanic	71	2	9	2	10	1
White	2948	86	329	85	603	90
Asian-American	158	5	21	5	30	5
Other	68	2	7	2	18	3
Total US Citizens	3405	100%	387	100%	671	100%

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The 70 departments with an astronomy degree program fall into two distinct groups (see **Table 9**). About half are stand-alone departments devoted strictly to the field of astronomy, while the remaining half are administered in conjunction with a physics program. This year we received responses from all but one astronomy department. It should be noted that students also receive degrees in astrophysics from stand-alone physics departments. These astrophysics degrees are included in the totals for physics departments presented earlier.

Table 9. Number of degree-granting astronomy departments by highest astronomy degree offered, academic year 1999-00.

Department Type	Combined with physics	Separate astronomy	Total
PhD-granting	9	29	38
Master's-granting	2	2	4
Bachelor's-granting	23	5	28
Total	34	36	70

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Table 10. Introductory astronomy course enrollments by department type, academic year 1998-99.

	Bachelor's-granting	Master's-granting	Doctoral-granting	Total
Astronomy & combined departments	8600	2800	40,500	51,900
Physics department*	45,000	18,900	41,000	104,900
Total	53,600	21,700	81,500	156,800

* The introductory astronomy enrollments at physics departments are also included in Table 2 of this report.

Note: Table only includes enrollments at degree-granting physics and astronomy departments.

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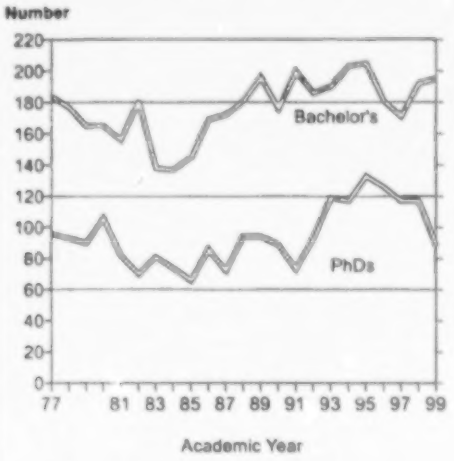
Approximately 156,800 students took an introductory astronomy course during the 1998-99 academic year (see **Table 10**). As has been historically true, two-thirds of these students took that course in a physics department that had no astronomy degree program.

The astronomy class of 1998-99 consisted of 195 bachelor's degrees, 23 exiting master's and 88 doctorates (see **Figure 8**). While the undergraduate astronomy degree production has remained fairly stable in recent years, PhD production has experienced a declined.

Women are better represented among astronomy degree recipients than they are in physics. Foreign students have a considerably smaller presence among the astronomy graduate degree recipients than is true in physics (see **Table 11**).

Figure 8. Astronomy bachelor's degrees and doctorates awarded in the US, 1977-1999.



Note: The astronomy doctorate totals presented here do not include astrophysics degrees conferred by physics departments. Those degrees are included among the physics totals.

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Table 11. Percent of women and foreign citizens among recent astronomy degree recipients, Class of 1999.

Degree	Women %	Foreign* %
Bachelor's	32	6
Exiting Master's	39	22
PhDs	26	28

* Foreign citizens include individuals with permanent resident status and temporary visas.

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APPENDIX

A1. Trend in astronomy enrollments* and degrees, academic years 1989 to 2000.

Academic Year	Number of astronomy degrees granted			Undergraduate astronomy major enrollments		Graduate astronomy student enrollments	
	Bachelor's	Exiting Master's	PhDs	Juniors	Seniors	1st-year	Total
1989-90	176	19	89	223	236	186	842
1990-91	200	25	73	312	284	226	914
1991-92	186	31	93	290	331	175	935
1992-93	190	56**	119	337	348	173	939
1993-94	203	34	117	257	388	180	901
1994-95	205	43	133	269	351	165	905
1995-96	181	44	126	272	361	149	874
1996-97	177	23	117	265	332	155	837
1997-98	192	29	116	252	330	143	777
1998-99	195	23	88	263	340	165	799
1999-00				395	409	187	838

* Includes part-time students.

** Thirty-four Master's came from the Arizona Summer Science Institute for science teachers at the University of Arizona.

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A2. Trend in physics enrollments* and degrees, academic years 1989 to 2000.

Academic Year	Number of physics degrees			Undergraduate physics major enrollments		Graduate physics student enrollments	
	Bachelor's	Exiting Master's	PhDs	Juniors	Seniors	1st-year	Total
1989-90	4898	918	1183	6313	7131	3059	13708
1990-91	4950	806	1264	6445	7115	3278	14065
1991-92	4770	906	1346	6435	7268	3306	14534
1992-93	4800	877	1369	6287	7297	3090	14430
1993-94	4615	1077	1481	6146	7289	2902	14201
1994-95	4263	985	1461	5620	6836	2604	13285
1995-96	4156	959	1438	5335	6489	2462	12596
1996-97	3826	789	1385	5057	6116	2404	11786
1997-98	3821	782	1323	5006	5857	2423	11302
1998-99	3646	671	1262	5026	5593	2417	10971
1999-00				5227	5913	2510	10768

* Includes part-time students.

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A3. Trend in physics enrollments* and degrees by institution type, academic years 1989 to 2000.

Academic Year	Number of physics degrees granted			Undergraduate physics major enrollments		Graduate physics student enrollments	
	Bachelor's	Exiting Master's	PhDs	Juniors	Seniors	1st-year	Total
Doctorate-granting institutions							
1989-90	2365	551	1183	2877	3664	2623	12440
1990-91	2376	502	1264	3082	3694	2782	12700
1991-92	2261	518	1346	3057	3729	2831	13118
1992-93	2253	543	1369	3038	3845	2688	13222
1993-94	2203	732	1481	2920	3729	2509	13042
1994-95	2009	665	1461	2648	3453	2209	12173
1995-96	1918	644	1438	2461	3344	2117	11545
1996-97	1746	535	1385	2200	3133	2074	10900
1997-98	1710	516	1323	2223	2899	2127	10432
1998-99	1688	487	1262	2363	2814	2174	10256
1999-00				2412	3053	2304	10104
Master's-granting institutions							
1989-90	494	367		773	969	436	1268
1990-91	541	304		800	956	496	1365
1991-92	525	388		802	938	475	1416
1992-93	448	334		719	887	405	1208
1993-94	475	345		696	930	393	1159
1994-95	420	320		610	813	395	1113
1995-96	376	315		556	703	345	1047
1996-97	314	254		530	667	330	886
1997-98	320	266		561	636	296	870
1998-99	275	184		478	576	243	715
1999-00				465	589	206	664
Bachelor's-granting institutions							
1989-90	2039			2663	2498		
1990-91	2033			2563	2470		
1991-92	1984			2576	2601		
1992-93	2099			2530	2565		
1993-94	1937			2530	2630		
1994-95	1834			2362	2570		
1995-96	1862			2318	2442		
1996-97	1766			2327	2316		
1997-98	1791			2225	2322		
1998-99	1683			2185	2203		
1999-00				2348	2271		

* Includes part-time students.

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A detailed analysis of faculty openings and new hires in universities and four-year colleges.

**1998 Graduate Student Report (November 2000)

A summary of the characteristics and career goals of physics and astronomy graduate students.

*1999 Initial Employment Report: Follow-Up of 1998 Physics and Astronomy Degree Recipients (June 2001)

A description of the initial employment and continuing education of physics and astronomy degree recipients.

Mastering Physics for Non-Academic Careers (2001)

A detailed analysis of master's programs in physics departments in the U.S. including those that offer a master's as their highest physics degree and those that have a master's degree program in parallel with a physics PhD program in the same department.

* Physics and Astronomy Senior Report: Class of 1998 (December 1999)
(Formerly Bachelor's Degree Recipients Report)

Looks into the backgrounds, experiences, and future plans of physics and astronomy majors at the point of graduation.

***Physics in the High Schools IV (Maintaining Momentum: High School Physics for a New Millennium, 1997) (August 1999)

An analysis and interpretation of information collected in a nationwide survey of teachers of physics at the secondary level.

Physics in the Two-Year Colleges (Oct. 1998)

First comprehensive study of physics programs and faculty in the two-year colleges.

**2000 Salaries: Society Membership Survey (June 2001)

An analysis of the effect of factors such as geographic location, employment sector, gender, years from degree, and degree level on salary levels and salary increases. $15 for a single copy, $10 each for multiple copies.

(All orders must be prepaid. Make your check payable to the American Institute of Physics and mail it to the address above.)

** 2000: Salaries Summary Report (March 2000)
Only available from the Web at www.aip.org/statistics

A two-page summary which gives overall trends and salaries.

Women in Physics, 2000 (June 2000)

Data on the current and historic trends in the representation of women in physics, including comparative data on women in related fields.

* Published annually

** Published biennially

*** Published triennially